P R I D E

Policy based Routing

Implementation, Deployment in Europe

A Project Proposal

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The Need

In todays Internet environment, policy based routing technology providing routing of traffic between different network operators is a key technology. While tools are available to apply routing policy they are not used in a coordinated way if used at all. In a general mesh topology applying policy without coordination and prior simulation of the consequences will eventually lead to an unmanageable situation. This potential problem has been noted in [1] and several of the references cited therein.

As an immediate measure the GIX (Global Internet Exchange) has been proposed in [2] and a proposal for a GIX routing implementation has been made in [3]. It is noteworthy that the GIX only solves part of the problem: routing consistency and connectivity at the global level. In order for the Internet to cope with its current growth, the routing problem will also need to be solved at the regional and local levels. The "RS" project (1) has recognised this by spending significant resources on establishing consensus within RIPE on how routing policies are stored in the European routing registry[4]. Once registered the information can be used to ensure proper operation of the European part of the Internet. The project is making significant progress in this area. The routing registry and tools being developed are much more general than those used and proposed so far for use in the current Internet. It is expected that the architecture will eventually allow multiple major interconnect points as envisaged in [1].

In order to promote the European routing registry and the associated technology two key ingredients are needed:

Implementation

> A set of tools for use by local network operators needs to be developed. The "RS" project deals only with the tools needed by the route server itself. While some of these can be adapted there are not sufficient resources to properly produce tools for local network operators. These tools will enable them to use the routing policy stored in the routing registry to perform such tasks as check actual routing against policies defined, ensure consistency of policies set by different operators, and simulate the effects of policy changes.

Deployment

> In order to be useful the routing registry and associated tools need to be deployed rapidly by all significant network operators in the European Internet. This means there is a big need for information and training of the network operator staff, coordination of deployment and support activities. If enough information and education pressure can be applied there is a good chance that the technology will be deployed outside Europe as well. First signs of this are already visible as the CIX (Commercial Internet eXchange) association has announced their intention to deploy a route server using the RIPE routing registry technology.

The urgent need for these two ingredients motivates this project proposal and has suggested the name PRIDE: Policy based Routing Implementation and Development in Europe.

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1) "Implementation of a Route Server for policy based routing across the GIX", a joint RARE/RIPE project currently funded by SURFnet.

The Results

The tangible results of the project will be tools and training materials for network operators. These results will be made freely and publicly available for everyone on the Internet.

Implementation

In the implementation area of the project, tools will be developed and documented. A complete list of those tools cannot be specified in advance since specific needs are likely to evolve during deployment. Flexibility to meet those needs and agree about priorities with the network operators is a key element to ensure acceptance and thus the success of the project. The tools will be released in packages called "PRIDE Tools Releases".

The tools are expected to include:

prcheck	A tool to check the consistency of routing policies stored in the routing registry. This tool will flag if two neighbouring network operators specify conflicting or inconsistent routing information exchanges with each other and also detect global inconsistencies where possible.
prpath	Extract all (AS-)paths between two networks which are allowed by routing policy from the routing registry.
prconn	Display the connectivity a given network has according to current policies. This will of course also be able to find the set of networks a given network can not reach.
prtraceroute	A version of the existing traceroute tool which will be able to display whether a route in use is allowed by policy and where deviations from policy occur.
prconfig	A router configuration generator. This will generate configuration files for specific routers from the routing registry and additional information supplied by the user.

The tools will be packaged into two PRIDE Tools releases. The first release will include basic tools and at least "prtraceroute" and "prconfig".

The range of implementable routing policies is currently limited by the destination based routing and forwarding technology. There are efforts underway to enable forwarding decisions based on the source of packets as well as the destination. The routing registry and tools will need to both follow and influence developments of destination based routing and forwarding in IPv4 as well as next generation IP.

Deployment

This is the key part of the project. Without widespread deployment of the routing registry at least in Europe the results of the "RS" project and the Implementation part of the PRIDE project will be academically interesting but not much more. The result of this part of the project is thus widespread deployment of the routing registry and associated tools as possible.

The tangible results will be the PRIDE Guide and the PRIDE Course.

PRIDE Guide

> The PRIDE Guide will be a document for network operators. It will describe procedures needed to use the routing registry, the way routing policies need to be expressed for registration and PRIDE tools.

PRIDE Course

> The PRIDE Course will teach network operators how to use the routing registry and the PRIDE tools to manage inter domain routing. The course will be focussed around the guide combined with the use of the PRIDE tools software release. The PRIDE Course will consist of a set of training materials. Several courses will be given during the project.

Associated with this will be a large effort of coordination of the actual deployment of the tools and the registration of routing policies in the routing registry.

The delivery of training and coordination and deployment will consume the bulk of the project resources. It should be noted however that the proposed resources are not sufficient for a general support or help desk function. This would need significantly more resources. Because we believe network operators will invest here in their own interest we propose to focus on targeting information and training well and to provide coordination only. The RIPE community will then form the network for mutual support as it has done successfully in the past.

The Partners

In order to realise the goals of this project, close cooperation with as many service providers as possible will be necessary. European service providers are already following and influencing the developments closely through RIPE. Both the amount of input received during the design of the routing registry and the rate at which information is being registered show this works well.

Worldwide contacts with groups involved in similar developments are also already established via RIPE, IEPG and IETF. The close coordination of all parties deploying route servers on the GIX and the recent announcement by the CIX association of their intention to use the RIPE routing registry technology are good examples of this.

The project will exploit these already existing channels and be open to new ways of reaching the service providers in particular. All service providers will have equal access to the tools, the routing registry itself and the information and training materials.

The Plan

The project will start September 1st 1993 (week 35). The plan is given in chronological order with milestones denoted as 'PRIDE-number'.

Time	Milestone	Activity/Result
Week 37		Presentation of project at RIPE meeting
Week 46	<PRIDE-1>	PRIDE Tools beta release 1 to selected testers
Week 49	<PRIDE-2>	PRIDE Tools release 1
Week 51		Pre-realease of PRIDE Guide materials
January 1994		PRIDE pre-course given in conjunction with RIPE meeting
Week 10	<PRIDE-3>	PRIDE Guide 1st edition
Week 10	<PRIDE-4>	PRIDE Course 1st edition
March/April		At least one additonal course based on 1st edition
Week 14	<PRIDE-5>	PRIDE Tools beta release 2 to selected testers
Week 17	<PRIDE-6>	PRIDE Tools release 2
Week 26	<PRIDE-7>	PRIDE Guide 2nd edition
Week 26	<PRIDE-8>	PRIDE Course 2nd edition
until August		Additonal courses as needed

The Resources

The resources needed for the PRIDE project are estimated as follows:

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The above resource levels are purely for the work specified and do not include formal project management and formal (non-technical) reporting.

After completion of the project and successful deployment of the routing registry, a level of maintenance effort will be needed for the tools and the routing registry. This should be a structural activity much like the current RIPE NCC core activities.

In order to start up quickly the implementation part can be started first as a sub-project with one engineer. It should be noted however that without the deployment effort following, this will have only a very limited effect.

References

[1] T. Kalin: "Global Network Interconnect", Amsterdam, 8 Jan. 93, EC(92)093v3

[2] G.Almes, P.Ford, P.Lothberg: "Proposal for Global Internet Connectivity", IEPG Working Document, June 1992

[3] Tony Bates, Daniel Karrenberg, Peter Lothberg, Bernhard Stockman, Marten Terpstra: "Internet Routing In a Multi Provider, Multi Path Open Environment", Document RIPE-82, March 1993

[4] Tony Bates, Jean-Michel Jouanigot, Daniel Karrenberg, Peter Lothberg, Marten Terpstra: "Representation of IP Routing Policies in the RIPE Database", Document ripe-81, March 1993